US009461497B2

(12) **United States Patent**
Tu et al.

(10) **Patent No.: US 9,461,497 B2**
(45) **Date of Patent: Oct. 4, 2016**

(54) **CHARGE DEVICE AND SYSTEM**

(71) Applicant: **LEADING TECH-SEMICONDUCTOR Co., LTD**, Hsinchu County (TW)

(72) Inventors: **Chia-Hao Tu**, Keelung (TW); **Ning Sung Chou**, Hsinchu County (TW)

(73) Assignee: **Leading Tech-Semiconductor Co., Ltd.**, Hsinchu County (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **14/591,889**

(22) Filed: **Jan. 7, 2015**

(65) **Prior Publication Data**

US 2015/0194824 A1 Jul. 9, 2015

Related U.S. Application Data

(63) Continuation of application No. 61/924,896, filed on Jan. 8, 2014.

(30) **Foreign Application Priority Data**

Dec. 12, 2014 (TW) ..... 103143430 A

(51) **Int. Cl.**
H02J 7/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H02J 7/007*** (2013.01); ***H02J 7/0054*** (2013.01); *H02J 2007/0059* (2013.01); *H02J 2007/0062* (2013.01)

(58) **Field of Classification Search**
CPC H02J 2007/0059; H02J 2007/0062; H02J 7/0054; H02J 7/007
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2008/0238356 A1* 10/2008 Batson H02J 7/0045 320/103
2012/0104994 A1* 5/2012 Esnard-Domerego H02J 7/0068 320/107

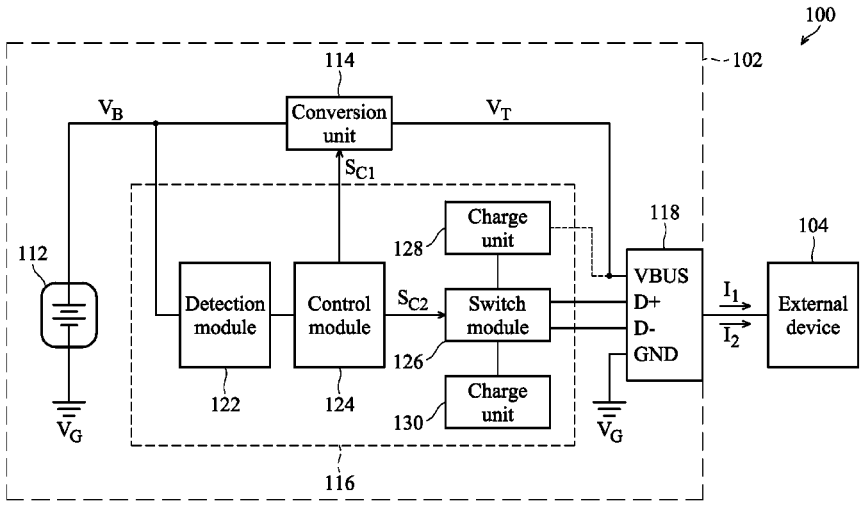
* cited by examiner

Primary Examiner — Vuthe Siek

(57) **ABSTRACT**

A charge device coupled to an external device is provided. A connection port is configured to couple to the external device and includes a first pin and a second pin. A battery unit has a battery voltage. A conversion unit converts the battery voltage to provide power to the external device. When the battery voltage is higher than a threshold value, a detection control unit directs the first and second pins to couple to a first charge unit and the connection port outputs a first charge current to the external device. When the battery voltage is not higher than the threshold value, the detection control unit directs the first and second pins to couple to a second charge unit and the connection port outputs a second charge current to the external device. The first charge current is greater than the second charge current.

20 Claims, 6 Drawing Sheets



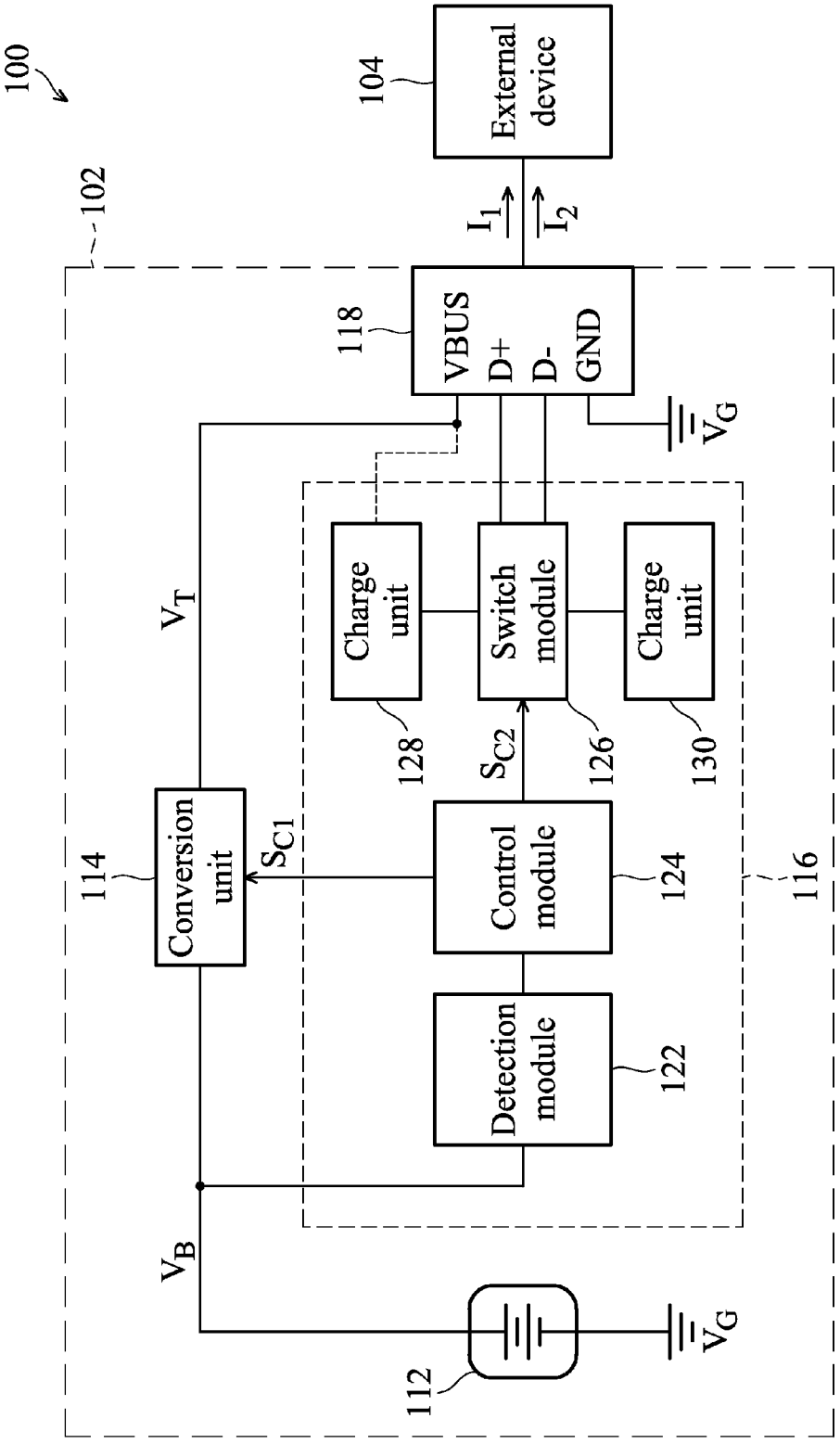

100
102
104
External device
I_1
I_2
118
VBUS
D+
D-
GND
V_G
V_T
Charge unit
Switch module
Charge unit
128
S_{C2}
126
130
114
Conversion unit
S_{C1}
Control module
124
116
Detection module
122
V_B
112
V_G

FIG. 1

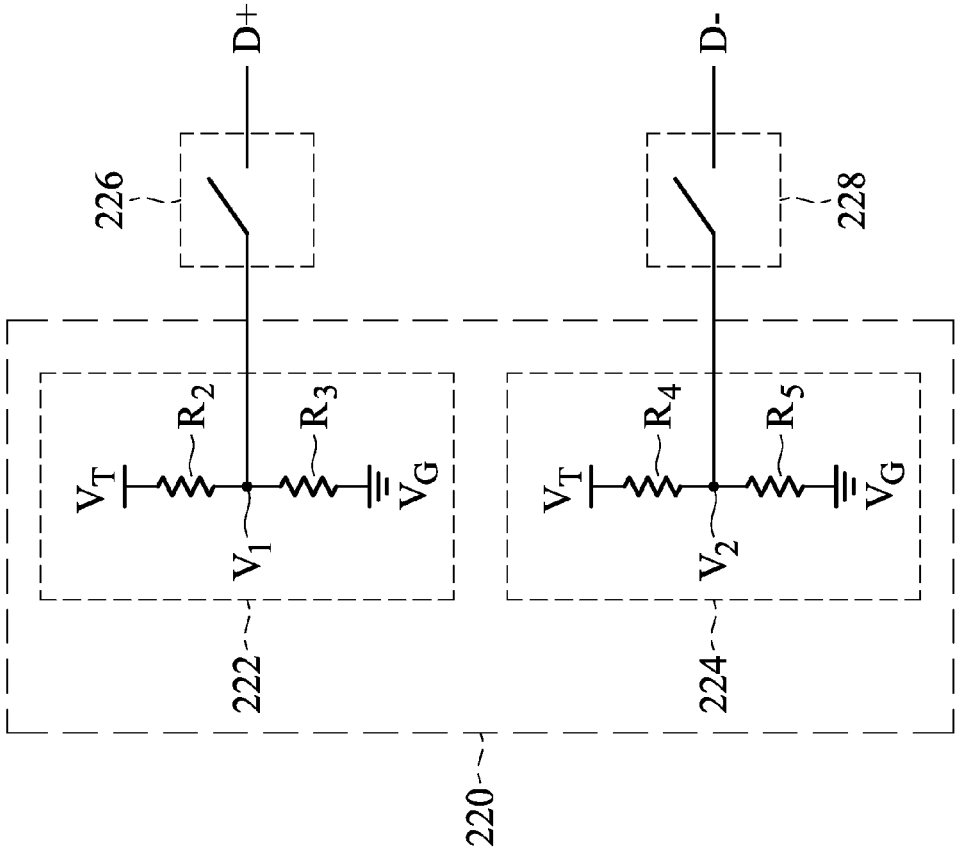


FIG. 2B

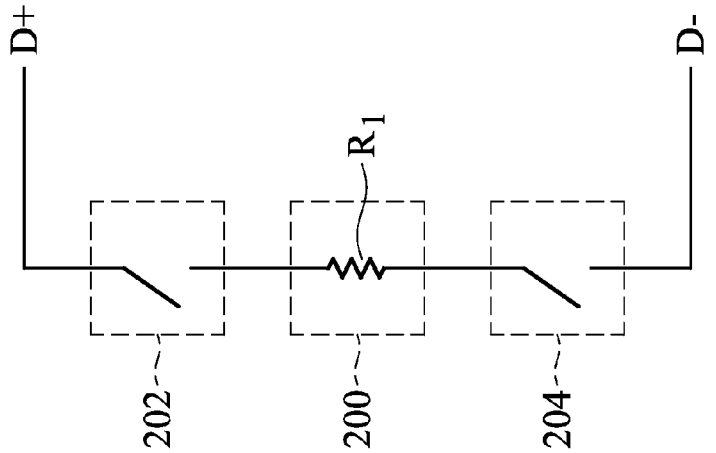


FIG. 2A

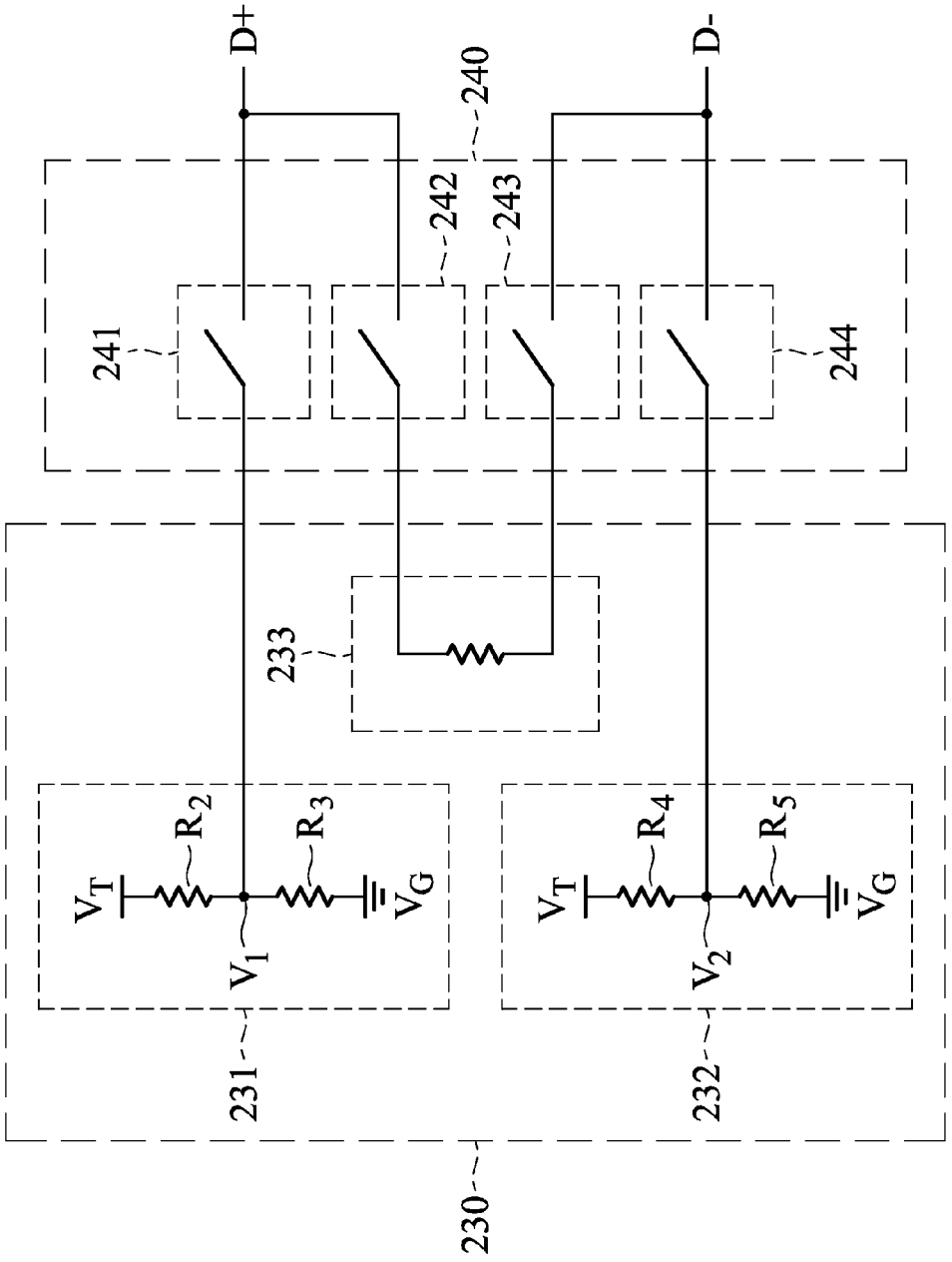


FIG. 2C

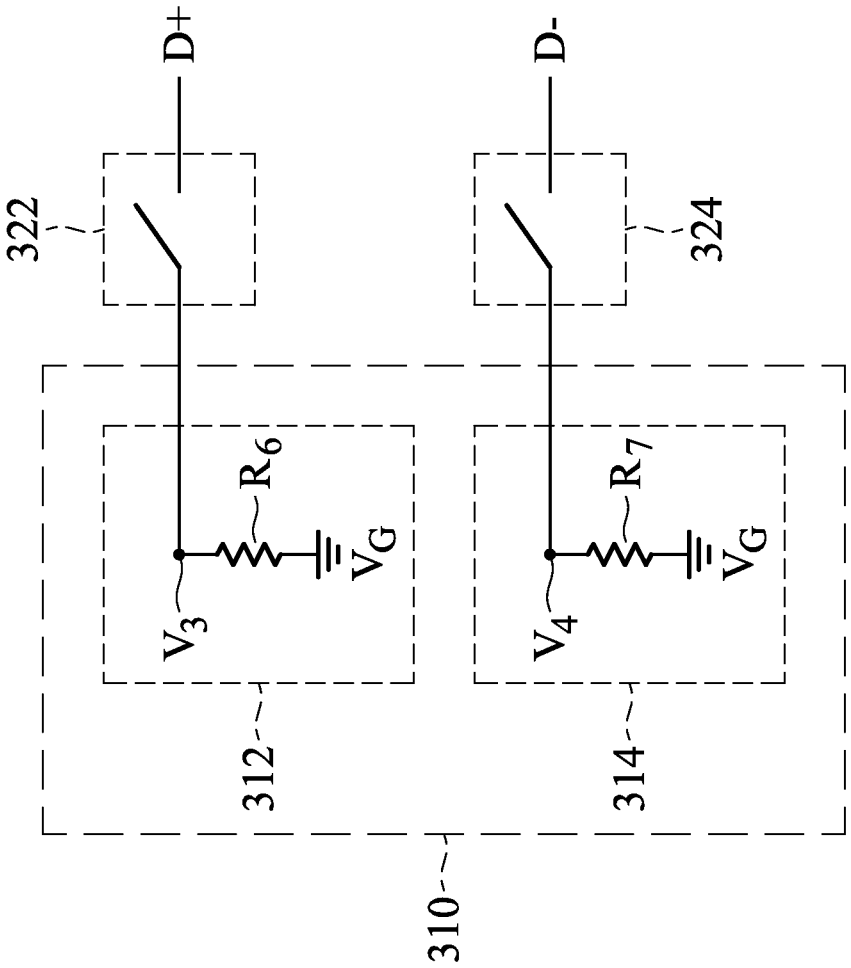


FIG. 3

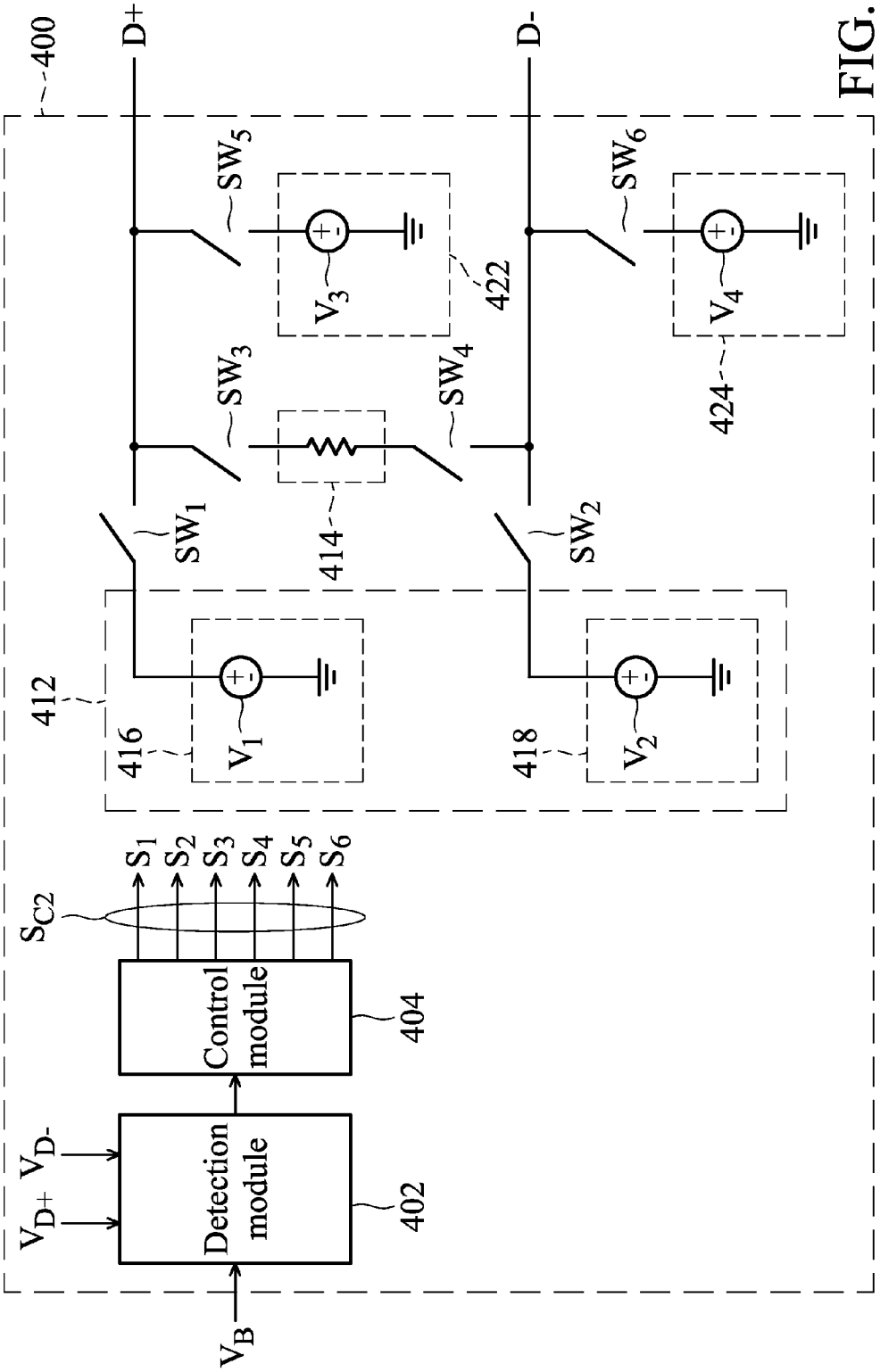

400
D+
D-
SW5
SW6
SW3
SW4
SW1
SW2
V3
V4
422
424
414
412
416
418
V1
V2
S1
S2
S3
S4
S5
S6
SC2
Control module
404
Detection module
402
VD+
VD-
VB

FIG. 4

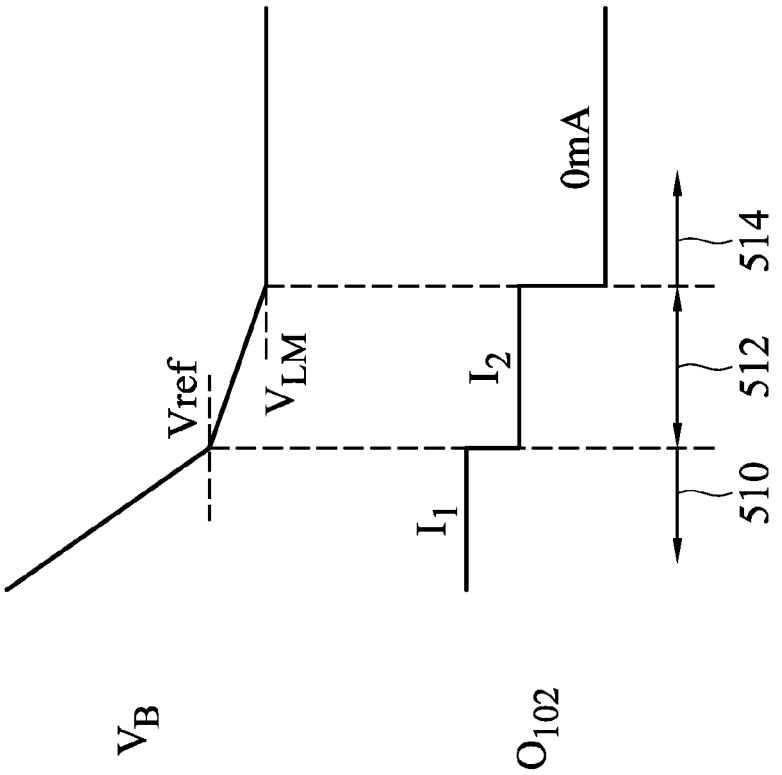


FIG. 5

CHARGE DEVICE AND SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/924,896, filed on Jan. 8, 2014, and Taiwan Patent Application No. 103143430, filed on Dec. 12, 2014, which are hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a charge device, and more particularly to a charge device that provides different charge current.

2. Description of the Related Art

As technology develops, new types of electronic device are being developed.

To increase convenience, various electronic devices are designed to be portable. Each portable devices comprises a rechargeable battery to provide power to the elements of the device. When the charge on the rechargeable battery is not low, the electronic device cannot work normally. Therefore, the rechargeable battery requires charging to ensure that the electronic device works normally.

BRIEF SUMMARY OF THE INVENTION

In accordance with an embodiment, a charge device is coupled to an external device and comprises a connection port, a battery unit, a conversion unit and a detection control unit. The connection port is configured to couple to the external device and comprises a first pin and a second pin. The battery unit has a battery voltage. The conversion unit converts the battery voltage to provide power to the external device. The detection control unit directs the first and second pins to couple to a first charge unit when the battery voltage is higher than a threshold value. The detection control unit directs the first and second pins to couple to a second charge unit when the battery voltage is not higher than the threshold value. When the first and second pins are coupled to the first charge unit, the connection port outputs a first charge current to the external device. When the first and second pins are coupled to the second charge unit, the connection port outputs a second charge current to the external device. The first charge current is greater than the second charge current.

In accordance with another embodiment, a charge system comprises a charge device and an external device. The charge device provides a first charge current or a second charge current and comprises a connection port, a battery unit, a conversion unit and a detection control unit. The connection port comprises a first pin and a second pin. The battery unit has a battery voltage. The conversion unit converts the battery voltage. The detection control unit directs the first and second pins to couple to a first charge unit when the battery voltage is higher than a threshold value. The detection control unit directs the first and second pins to couple to a second charge unit when the battery voltage is not higher than the threshold value. When the first and second pins are coupled to the first charge unit, the connection port outputs the first charge current. When the first and second pins are coupled to the second charge unit, the connection port outputs the second charge current. The first charge current is greater than the second charge current.

The external device is coupled to the connection port to receive the first or second charge current.

A detailed description is given in the following embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more fully understood by referring to the following detailed description and examples with references made to the accompanying drawings, wherein:

FIG. **1** is a schematic diagram of an exemplary embodiment of a charge system, in accordance with some embodiments;

FIGS. **2**A~**2**C and **3** are schematic diagrams of exemplary embodiments of a charge unit, in accordance with some embodiments;

FIG. **4** is a schematic diagram of an exemplary embodiment of a detection control unit, in accordance with some embodiments; and

FIG. **5** is a schematic diagram of a battery voltage, in accordance with some embodiments.

DETAILED DESCRIPTION OF THE INVENTION

The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

FIG. **1** is a schematic diagram of an exemplary embodiment of a charge system, in accordance with some embodiments. As shown in FIG. **1**, the charge system **100** comprises a charge device **102** and an external device **104**. The charge device **102** outputs a first charge current or a second charge current according to the voltage of a battery disposed in the charge device **102** to charge the external device **104**. In one embodiment, the charge device **102** is a mobile bank.

When the battery voltage of the charge device **102** stores enough energy, the charge device **102** provides a large charge current. When the battery voltage of the charge device **102** does not store enough energy, the charge device **102** outputs a small charge current. For example, when the battery voltage of the charge device **102** is higher than a threshold value, the charge device **102** outputs a first charge current I_1, and when the battery voltage of the charge device **102** is not higher than the threshold value, the charge device **102** outputs a second charge current I_2. The first charge current I_1 is larger than the second charge current I_2.

In this embodiment, the charge device **102** comprises a battery unit **112**, a conversion unit **114**, a detection control unit **116** and a connection port **118**. The connection port **118** is configured to couple to the external device **104** and comprises various pins. In this embodiment, the connection port **118** is a USB port and comprises pins VBUS, D+, D− and GND. The pin VBUS transmits a charge voltage V_T. The pin GND transmits a ground voltage V_G. The invention does not limit the kind of connection port **118** that can be used. Any connection device can serve as the connection port **118**, as long as the connection device is capable of transmitting power to the external device **104**.

The battery unit **112** provides a battery voltage V_B. The invention does not limit the structure of battery unit **112**. In one embodiment, the battery unit **112** comprises at least one rechargeable battery. When the battery unit **112** comprises more rechargeable batteries, the rechargeable batteries are

connected to each other in series or in parallel. The invention does not limit the kind of rechargeable battery that can be used. Any device can serve as the rechargeable battery, as long as the device is capable of storing and discharging power.

The conversion unit **114** converts the battery voltage V_B to generate a charge voltage V_T and provides the charge voltage V_T to the external device **104** via the pin VBUS of the connection port **118**. In one embodiment, the conversion unit **114** is a boost circuit or a buck circuit. In this embodiment, the conversion unit **114** performs a voltage conversion operation according to a control signal S_{C1}. For example, when the control signal S_{C1} is asserted, the conversion unit **114** converts the battery voltage V_B, and when the control signal S_{C1} is de-asserted, the conversion unit **114** stops converting the battery voltage V_B.

The detection control unit **116** controls the connection state between the pins

D+ and D− of the connection port **118**. In this embodiment, the detection control unit **116** comprises a detection module **122**, a control module **124**, a switch module **126**, and charge units **128** and **130**.

The detection module **122** detects the battery voltage V_B. The invention does not limit the internal circuit structure of the detection module **122**. Any circuit can serve as the detection module **122**, as long as the circuit is capable of detecting voltage. In one embodiment, the detection module **122** is a voltage detector. In another embodiment, the detection module **122** is a voltage comparator to determine whether the battery voltage V_B is higher than a threshold value.

The control module **124** generates control signals S_{C1} and S_{C2} according to the detection result generated by the detection module **122**. In one embodiment, if the detection module **122** is just a voltage detector, the control module **124** has a voltage-compare function to determine whether the detection result generated by the detection module **122** is higher than a threshold value. In another embodiment, if the detection module **122** is a voltage comparator, the control module **124** can directly utilize the compared result generated by the voltage comparator to generate the control signals S_{C1} and S_{C2}.

In one embodiment, when the battery voltage V_B is higher than a threshold value, the control module **124** asserts the control signal S_{C1} to direct the conversion unit **114** to convert the battery voltage V_B. In another embodiment, when the battery voltage V_B is not higher than the threshold value, the control module **124** still asserts the control signal S_{C1} or first momentarily de-asserts the control signal S_{C1} and then asserts the control signal S_{C1}. In other embodiments, when the battery voltage V_B is not higher than the threshold value and is lower than a limiting value, it means that the voltage of the battery unit **112** is at a minimum. Therefore, the control module **124** de-asserts the control signal S_{C1} to stop converting the battery voltage V_B.

In this embodiment, the control module **124** changes the connection state between the pins D+ and D− of the connection port **118** according to the battery voltage V_B. The external device **104** operates in a fast charge mode or in a slow charge mode according to the connection state between the pins D+ and D− of the connection port **118**. In the fast charge mode, the external device **104** captures a larger charge current from the charge device **102**. In the slow charge mode, the external device **104** captures a small charge current from the charge device **102**.

The switch module **126** directs the pins D+ and D− to connect to the charge unit **128** or **130** according to the control signal S_{C2}. In this embodiment, when the battery voltage V_B is higher than a threshold value, the switch module **126** directs the pins D+ and D− to connect to the charge unit **128**. Therefore, the external device **104** enters in a fast charge mode. When the battery voltage V_B is not higher than the threshold value, the switch module **126** directs the pins D+ and D− to connect to the charge unit **130**. Therefore, the external device **104** enters a slow charge mode.

In one embodiment, when the pins D+ and D− are coupled to the charge unit **128**, the connection port **118** outputs the charge current I_1. When the pins D+ and D− are coupled to the charge unit **130**, the connection port **118** outputs the charge current I_2. In this embodiment, the charge current I_2 is smaller than the charge current I.

FIG. **2**A is a schematic diagram of an exemplary embodiment of a charge unit, in accordance with some embodiments. As shown in FIG. **2**A, the charge unit **200** is a resistor R_1. The resistor R_1 is configured between the pin D+ and the pin D−. In this embodiment, the switch module **126** comprises switches **202** and **204**. When the battery voltage V_B is higher than a threshold value, the switches **202** and **204** are turned on. Therefore, the pin D+ is connected to the pin D−. When the battery voltage V_B is not higher than the threshold value, the switches **202** and **204** are turned off. Thus, the pin D+ is not connected to the pin D−. In one embodiment, the control module **124** turns on or off the switches **202** and **204**.

FIG. **2**B is a schematic diagram of another exemplary embodiment of a charge unit, in accordance with some embodiments. The charge unit **220** comprises charge modules **222** and **224**. The charge module **222** performs a first operation for the charge voltage V_T to generate a voltage V_1. The charge module **224** performs a second operation for the charge voltage V_T to generate a voltage V_2. In this embodiment, the processing degree of the charge module **222** is different from that of the charge module **224**. Therefore, the voltage V_1 is different from the voltage V_2. In other embodiment, the charge modules **222** and **224** process the battery voltage V_B. The processing degree of the charge module **222** is different from that of the charge module **224**. Therefore, the processed results generated by the charge modules **222** and **224** are different.

In this embodiment, the charge module **222** comprises resistors R_2 and R_3. The resistors R_2 and R_3 are serially connected between the charge voltage V_T and the ground voltage V_G to divide the charge voltage V_T. In other embodiments, the charge module **222** is a voltage source to provide a voltage, such as V_1, to the pin D+.

Additionally, the charge module **224** comprises resistors R_4 and R_5. The resistors R_4 and R_5 are serially connected between the charge voltage V_T and the ground voltage V_G to divide the charge voltage V_T. In some embodiments, the charge module **224** can be a voltage source to provide a voltage, such as V_2, to the pin D−.

When the battery voltage V_B is higher than a threshold value, the control module **124** turns on the switch **226** to provide voltage V_1 to the pin D+and turns on the switch **228** to provide voltage V_2 to the pin D−. When the battery voltage V_B is not higher than the threshold value, the control module **124** turns off the switches **226** and **228** to stop providing voltages V_1 and V_2 to the pins D+ and D−.

In this embodiment, since the connection port **118** is a USB connection port, two voltages (e.g. V_1 and V_2) are provided to two pins (e.g. D+ and D−). In another embodiment, if the connection port **118** is another kind of connection port, only one voltage (e.g. V_1 or V_2) is provided to one

pin of the connection port **118**. In some embodiments, three or more voltages are provided to three or more pins of the connection port **118**.

FIG. **2**C is a schematic diagram of an exemplary embodiment of a charge unit, in accordance with some embodiments. As shown in FIG. **2**C, the charge unit **230** comprises charge modules **231**~**233**. Additionally, the switch module **240** comprises switches **241**~**244**. The charge module **231** processes the charge voltage V_T to generate the voltage V_1. The charge module **232** processes the charge voltage V_T to generate the voltage V_2. The charge module **233** is connected between the pins D+ and D−. In some embodiments, the charge modules **231** and **232** process the battery voltage V_B.

When the battery voltage V_B is higher than a threshold value, the control module **124** controls the switches **241**~**244** according to the voltage levels of the pins D+ and D−. In one embodiment, the control module **124** first turns on the switches **241** and **244** to provide voltages V_1 and V_2 to the pins D+ and D− and determines whether the voltage levels of the pins D+ and D− are changed.

When the external device **104** is coupled to the connection port **118** and does not change the voltage levels of the pins D+ and D−, it means that the voltage levels of the pins D+ and D− conform to a pre-determined state. Therefore, the control module **124** still turns on the switches **241** and **244** such that the pins D+ and D−are coupled to the charge modules **231** and **232**. When the voltage levels of the pins D+ and D− are changed and does not conform to the pre-determined state, the control module **124** turns on the switches **242** and **243** such that the pin D+ is connected to the pin D−.

FIG. **3** is a schematic diagram of an exemplary embodiment of a charge unit, in accordance with some embodiments. In this embodiment, the charge unit **310** comprises charge modules **312** and **314**. The charge module **312** provides the voltage V_3. The charge module **314** provides the voltage V_4. In this embodiment, the charge module **312** is a resistor R_6 and the charge module **312** receives the ground voltage V_G to generate the voltage V_3. Furthermore, the charge module **314** is a resistor R_7 and the charge module **314** receives the ground voltage V_G to generate the voltage V_4. In one embodiment, the voltages V_3 and V_4 are both the same and are within a range of 0V and 5V.

When the battery voltage V_B is not higher than a threshold value, the control module **124** turns on the switches **322** and **324** to provide voltage V_3 to the pin D+ and provide voltage V_4 to the pin D−. The external device **104** operates in a slow charge mode according to the voltage levels of the pins D+ and D−. In this mode, the charge device **102** provides a small charge current (e.g. I_2) to the external device **104**.

However, when the battery voltage V_B is higher than the threshold voltage, the control module **124** turns off the switches **322** and **324**. In one embodiment, the control module **124** turns on the switches **202** and **204** shown in FIG. **2**A or the switches **226** and **228** shown in FIG. **2**B. Therefore, the external device **104** operates in a fast charge mode. In this mode, the charge device **102** provides a large charge current, such as I_1 .

FIG. **4** is a schematic diagram of an exemplary embodiment of a detection control unit, in accordance with some embodiments. In this embodiment, the detection control unit **400** comprises a detection module **402**, a control module **404**, charge units **412**, **414**, **422** and **424**, and switches SW_1~SW_6. The charge unit **412** comprises charge modules **416** and **418**. Since the operation of the detection module **402** is the same as the detection module **122** shown in FIG. **1**, the description of the detection module **402** is omitted.

The control module **404** generates the control signal S_{C2} according to the detection result generated by the detection module **402**. In this embodiment, the control signal S_{C2} comprises control components S_1~S_6 to control the switches SW_1~SW_6 respectively. The invention does not limit the number of control components that can be used. In one embodiment, the number of control components is related to the kind of switches SW_1~SW_6. For example, if the switch SW_1 is an N-type transistor and the switch SW_3 is a P-type transistor, the control module **404** only utilizes a single control component to turn on the switch SW_1 or SW_3. If the switches SW_1 and SW_3 are N-type or P-type transistors, the control module **404** needs to utilize two control components to control the switches SW_1 and SW_3.

When the battery voltage V_B is higher than a threshold value, the control module **404** utilizes the control components S_1~S_6 to turn off the switches SW_3~SW_6 and to turn on the switches SW_1 and SW_2. Therefore, the charge module **416** provides the voltage V_1 to the pin D+ and the charge module **418** provides the voltage V_2 to the pin D− . Since the pin D+ receives the voltage V_1 and the pin D− receives the voltage V_2, the external device **104** enters a fast charge mode. At this time, the detection module **402** detects the voltage levels of the pins D+ and D−. The control module **404** determines whether to turn on the switches SW_1 and SW_2 according to the detection result generated by the detection module **402**.

In one embodiment, when the voltage levels of the pins D+ and D− conform to a pre-determined state, the control module **404** still turns on the switches SW_1 and SW_2 to continuously provide the voltages V_1 and V_2. Therefore, the external device **104** still operates in the fast charge mode. However, when the voltage levels of the pins D+ and D− do not conform to the pre-determined state, the control module **404** turns on the switches SW_3 and SW_4 and turns off the switches SW_1~SW_2 and SW_5~SW_6 such that the pin D+is connected to the pin D−.

When the battery voltage V_B is not higher than the threshold value, the control module **404** utilizes the control components S_1~S_6 to turn on the switches SW_5 and SW_6 and turn off the switches SW_1~SW_4. Therefore, the charge unit **422** provides the voltage V_3 to the pin D+ and the charge unit **424** provides the voltage V_4 to the pin D−. Since the pin D+ receives the voltage V_3 and the pin D− receives the voltage V_4, the external device **104** enters a slow charge mode and captures a small charge current from the charge device **102**. Therefore, the battery voltage V_B of the battery unit disposed in the charge device **102** is gradually reduced.

FIG. **5** is a schematic diagram of a battery voltage, in accordance with some embodiments. Refer to FIGS. **1** and **5**, during period **510**, since the battery voltage V_B is higher than a threshold value Vref, the control module **124** directs the pins D+ and D− to connect to the charge unit **128**. The external device **104** operates in a fast charge mode according to the states of the pins D+ and D− and captures a large charge current from the charge device **102**.

During period **512**, the battery voltage V_B is not higher than the threshold value Vref such that the control module **124** directs the pins D+ and D− to connect to the charge unit **130**. The external device **104** operates in a slow charge mode according to the states of the pins D+ and D− and captures a small charge current (e.g. I_2) from the charge device **102**.

During period **514**, the battery voltage V_B is not higher than the limiting value V_{LM} such that the control module **124**

de-asserts the control signal S_{C1} to stop providing the charge voltage V_T to the external device **104**.

Since the charge device **102** provides the appropriate charge current to the external device **104** according to the internal battery voltage V_B, when the battery voltage V_B is low, the charge device **102** changes the pin state of the connection port **108** to provide a small charge current to effectively use the battery voltage V_B.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A charge device coupling to an external device, comprising:

a connection port configured to couple to the external device and comprising a first pin and a second pin;

a battery unit having a battery voltage;

a conversion unit converting the battery voltage to provide power to the external device; and

a detection control unit directing the first and second pins to couple to a first charge unit when the battery voltage is higher than a threshold value, and directing the first and second pins to couple to a second charge unit when the battery voltage is not higher than the threshold value;

wherein when the first and second pins are coupled to the first charge unit, the connection port outputs a first charge current to the external device, when the first and second pins are coupled to the second charge unit, the connection port outputs a second charge current to the external device, and the first charge current is greater than the second charge current.

2. The charge device as claimed in claim **1**, wherein the first charge unit directs the first pin to connect to the second pin.

3. The charge device as claimed in claim **1**, wherein the first charge unit executes a first operation for the battery voltage to generate a first voltage to the first pin and generate a second voltage to the second pin.

4. The charge device as claimed in claim **1**, wherein the first charge unit comprises:

a first charge module directing the first pin to connect to the second pin; and

a second charge module processing the battery voltage to generate the first and second voltages,

wherein the detection control unit directs the first pin to couple to the second charge module and detects a level of the first pin, when the voltage level of the first pin conforms to a pre-determined state and the battery voltage is higher than the threshold value, the detection control unit directs the first and second pins to remain coupled to the second charge module, and when the voltage level of the first pin does not conform to the pre-determined state and the battery voltage is not higher than the threshold value, the detection control unit directs the first and second pins to couple to the first charge module.

5. The charge device as claimed in claim **1**, wherein the second charge unit provides a third voltage to the first pin and provides a fourth voltage to the second pin.

6. The charge device as claimed in claim **5**, wherein the second voltage is within 0V~5V.

7. The charge device as claimed in claim **5**, wherein the second charge unit is a resistor generating the second voltage according to a ground voltage.

8. The charge device as claimed in claim **1**, wherein when the battery voltage is not higher than the threshold voltage, the detection control unit first de-activates the conversion unit and then activates the conversion unit, and when the conversion unit is de-activated, the conversion unit stops converting the battery voltage.

9. The charge device as claimed in claim **1**, wherein when the battery voltage is not higher than the threshold voltage and a limiting value, the detection control unit de-activates the conversion unit to stop converting the battery voltage.

10. The charge device as claimed in claim **1**, wherein the connection port is a USB port.

11. A charge system comprising:

a charge device providing a first charge current or a second charge current and comprising:

a connection port comprising a first pin and a second pin;

a battery unit having a battery voltage;

a conversion unit converting the battery voltage; and

a detection control unit directing the first and second pins to couple to a first charge unit when the battery voltage is higher than a threshold value, and directing the first and second pins to couple to a second charge unit when the battery voltage is not higher than the threshold value;

wherein when the first and second pins are coupled to the first charge unit, the connection port outputs the first charge current, when the first and second pins are coupled to the second charge unit, the connection port outputs the second charge current, and the first charge current is greater than the second charge current; and

an external device coupled to the connection port to receive the first or second charge current.

12. The charge system as claimed in claim **11**, wherein the first charge unit directs the first pin to connect to the second pin.

13. The charge system as claimed in claim **11**, wherein the first charge unit executes a first operation for the battery voltage to generate a first voltage to the first pin and generate a second voltage to the second pin.

14. The charge system as claimed in claim **11**, wherein the first charge unit comprises:

a first charge module directing the first pin to connect to the second pin; and

a second charge module processing the battery voltage to generate the first and second voltages,

wherein the detection control unit directs the first pin to couple to the second charge module and detects a level of the first pin, when the voltage level of the first pin conforms to a pre-determined state and the battery voltage is higher than the threshold value, the detection control unit directs the first and second pins to remain coupled to the second charge module, and when the voltage level of the first pin does not conform to the pre-determined state and the battery voltage is not

higher than the threshold value, the detection control unit directs the first and second pins to couple to the first charge module.

15. The charge system as claimed in claim **11**, wherein the second charge unit provides a third voltage to the first pin and provides a fourth voltage to the second pin.

16. The charge system as claimed in claim **15**, wherein the second voltage is within 0V~5V.

17. The charge system as claimed in claim **15**, wherein the second charge unit is a resistor generating the second voltage according to a ground voltage.

18. The charge system as claimed in claim **11**, wherein when the battery voltage is not higher than the threshold voltage, the detection control unit first de-activates the conversion unit and then activates the conversion unit, and when the conversion unit is de-activated, the conversion unit stops converting the battery voltage.

19. The charge system as claimed in claim **11**, wherein when the battery voltage is not higher than the threshold voltage and a limiting value, the detection control unit de-activates the conversion unit to stop converting the battery voltage.

20. The charge system as claimed in claim **11**, wherein the connection port is a USB port.

* * * * *